The Hidden Sounds on Your Telephone Line

by ML Shannon

Have you ever thought about what might be happening on your telephone line while you are not using it? Probably not. After all, what could happen? Unless ... you start to wonder ... am I suggesting that someone might have tapped your phone?

No. At least not in the normal meaning of 'tap' where someone is monitoring your calls. If someone were, you probably wouldn't hear anything.

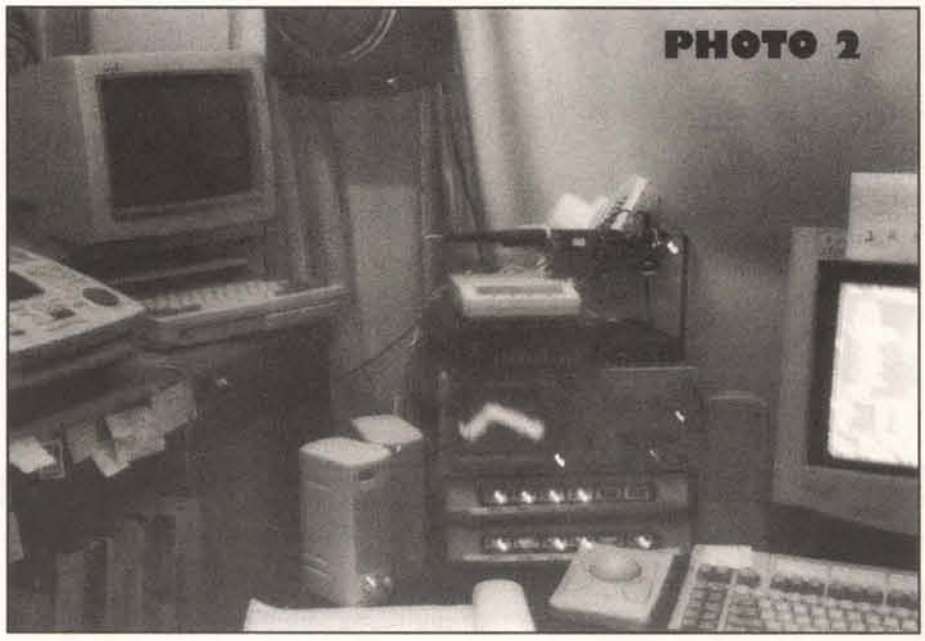
I refer here to the use of your line to make calls. And for testing purposes. Voices, sometimes, and exotic sounds like tones, chirps, rotary dialing clicks, analog data, and other noises are some of the sounds you will hear using the simple device described in this article. You can build it yourself for about $10.00.

More on this coming up, but first a look at telephone systems and wiring. It may be in any of several configurations, so I will use my neighborhood in San Francisco as an example.

When you first have telephone service installed, a computer system called COSMOS, or COmputer System for Mainframe OperationS will check your address to determine if there has previously been service there, and if so, the cable and pair numbers that were used. You are then assigned a number with a prefix in your area; a test is run to determine that the line is in working order, and the mainframe computer is programmed to turn on the Dial Tone. This may be at the Central Office (CO) or a technician may check the wiring at the other end, and from there request Dial Tone from the CO.

Now, your pair of wires begins its path to your phone from the Central Office. Your line is ported from the 'switch' – the mainframe computer – to a distribution frame. The frame, at least with the more modern systems, holds a large number of small printed circuit boards – 'cards' – each of which controls about eight individual lines. The computer and the frame, are called OE – Originating Equipment.

Then your pair – along with many others – goes from the distribution frame into the cable vault, frequently located below ground level, and then into the outside world. Your pair may be within any of various different types and sizes of cable, but typically, it will be an F1 Feeder Cable with 1,200 pairs. This wiring, once it leaves the CO is called the Outside Cable Plant.



Appearances

From the cable vault, there may be any number of appearances on your line, an appearance being a place where the line can be physically accessed. This includes:

Junction Points

A Junction Point (JP) is an underground maintenance area located beneath the street and accessed through a manhole where you sometimes see several Telco trucks parked. The large 'accordion' tube you see provides fresh air as methane gas is sometimes present.

Bridging Boxes

A 'B' or 'Bridging' Box – sometimes called Service Area Interface, which is usually located on a street corner or in an alley – is about three by five feet across and two feet deep.

Splicing Boots

In some areas, phone wires are overhead on telephone poles called 'aerials' so the pairs will go to an Aerial Service Terminal also known as a 'splicing boot' at the top of the pole.

Eventually, your pair of wires enters your home or apartment building one of two ways. Aerial wiring uses a Drop Wire that goes from the telephone pole to a small connection box on the outside of the building. Older types were an aluminum can about the size of a brick called a Single Pair Station Protector (SPSP) and newer types are plastic, called a Telephone Network Interface.

Underground wiring enters through a conduit and terminates at a panel often called a 66 block. The term '66' is, apparently, an old Bell System part number for a connection block with a 25 pair capacity.

Both of these are known as the Point of Demarcation or usually just 'demarc.' Beyond that, the (inside) wiring is the responsibility of the building owner.

This wiring – your pair from the CO to your telephone – is called a Loop or Local Loop – a loop of wire from the CO and back.

Multiples

What is significant about all this is that the pair of wires used for your line probably has been used for someone else's phone sometime in the past and it might still lead to a different location called a Multiple.

In the Junction Points – or if

above ground, the Splicing Boot – a certain number of pairs separate from the distribution cable and lead into your building. These pairs then terminate in that building – that is, they end there and don't double back.

So, when your pair separates, it is disconnected from continuing on to the next appearance by removing a jumper. But once in a while, this jumper is not removed, which means that your pair does continue on to another Junction Point and possibly into another house or apartment building. This is one way an illegal wiretap can be set up, if the tapper knows the right cable and pair numbers and can get into the JP.

Now, in a situation where this is true, your line will go into the 66 block at this other location and then might go to an unused modular block or may be connected with the heavy wire with thick black insulation used in older buildings and to a connection block that uses spade clips and screw terminals. It may have been there for years without anyone using it, especially the older type of wiring, and the block might be behind some piece of heavy furniture that hasn't been moved in years, such as a bookcase.

On the other hand, the block might be accessible, perhaps in an apartment that has been vacant for some time.

Sleepers

Now, one day, someone moves in, and they happen to plug a phone in to the modular jack and it works – there is dial tone. It becomes an extension phone on your line! Now, they may not realize this, they may assume that their new service has already been turned on since this can be done overnight. So, they would be able to make calls on your line. This is called a "Sleeper On The Line."

Incidentally, it is also possible that you might be a multiple on someone else's line. You can use the amplifier in this article to find out by checking any unused connection blocks you may have. And should you find dial tone, you will want to know whether or not it is your own line. You can do this by calling yourself which, of course, will get you a busy signal. But if your phone does ring, then you know you are calling from another number. Or you can use ANI, a number you call that has a computerized voice that reads back the number you have called from. Like other test numbers, ANI is proprietary but if you dig around on the web, you will eventually find one for your area.

The Hidden Sounds

It is not all that rare that there is a sleeper on your line; it does happen. So, you will, of course, hear the ordinary conversations that people make, unless there is something unusual happening at the other appearance. Or something unlawful, in which case you might want to immediately call 611, report 'unknown trouble,' and hope like heck the telco technician finds the sleeper!

Telco Technicians

Here is what happened to me while researching one of my books.

When telco technicians are making routine tests on the lines, or installing a new line, they go to an appearance, typically a B-Box. There, they need to call the Central Office and arrange to 'get dial tone' on a particular pair. And to do this, they need an available pair to use to connect their test or 'butt' sets. In some places – cities – there is a 'floater,' a line set aside for telco people for this purpose. But in others, there is no floater, so the technician just picks a pair that is 'handy.' I will explain.

Next time you see a technician working at an open B-Box, go over and have a look. On the inside of the door is a pair of terminals. It is these that the test set is connected to. From these terminals is connected a short pair of wires with clips on the end. These are used to connect to one of the punch down connectors in the B-Box. And since these wires are only so long (about 18 inches), they will reach to only so many of the terminals. So the technician picks one at random that is within reach, sets their test set to 'listen only' to see if the line is in use (at least most of the time they do!), and then uses it. They will call into the CO, answer pages, or maybe check their voice mail. Or, on rare occasions, they may make a few personal calls which can be very interesting sometimes!

And that's what happened to me. Quite a few times over six months or so, the techs were using my line. Unfortunately, this was my data line, and so I kept getting disconnected from the Internet without, at the time, knowing why.

In addition to voice conversations, there are other things you may hear.

Data

Where once the most sophisticated device telco installation people carried was the "butt" set, today they may have a small data terminal called Tele-Tech. These little gems

What does the law — local and Federal — say about using this simple device? You would be well-advised to consult an attorney, which I am not. But I do have an opinion. If you use it to listen in on a conversation that is taking place on an extension phone of your own line and the people talking are not made aware that you are listening, then this is unlawful.

As to crosstalk, you probably won't be able to make out much of what is being said, but you are not 'tapping' the other lines. You are simply monitoring your own line and someone else is "using" it without your permission.

Now with Telco technicians using your line, well, this is problematic. I suspect that they aren't really supposed to use a person's line without their permission, but the Communications Act of 1934 may apply here — accessing any line for maintenance purposes — another question best answered by an attorney.

Sources

Amplifiers, parts, cables
Alltronics
2300 Zanker Road
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www.alltronics.com

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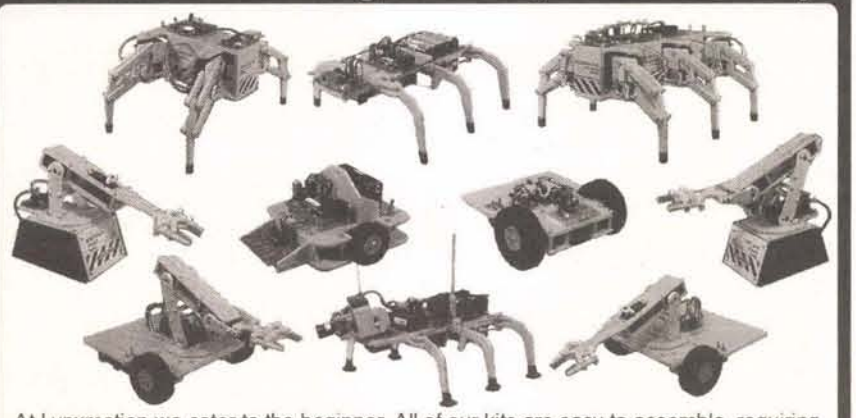

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It has been my experience that many telco maintenance people are friendly and will chat with you especially if you know some of the terminology. So, you can always try. Ask if this B-Box goes to your address, or if they can check for multiples, or whatever interests you. I have had some fascinating conversations with telco people. But, of course, they won't tell you everything they know ... Incidentally, if they happen to be having a conversation with their butt set, be polite and wait till they are through rather than interrupting them.

are used to connect to various telco facilities and I just happened to hear one in use a few months ago. A technician was (again!) accessing the B-Box half a block away that contains the distribution cable leading to my apartment building and I heard the sound of slow analog data (later I learned it was 9600 baud) coming from the speaker. And, as I had a DTMF decoder (Photograph 1) on the line, I was able to get the 800 number the tech had called!

Crosstalk

We have all heard crosstalk, the faint sounds of other people's conversations that 'leak' into our lines. You may hear this, sometimes, especially in an area where moisture gets into the lines, and even more so if the cables are very old and use cloth insulation. This frequently happens after an unusually heavy rainfall. Here in San Francisco, it was once so bad – during El Nino incidentally – that people in this apartment building could actually converse with each other! It was scratchy, and you had to raise your voice quite a lot (perhaps like Mr. Bell demonstrating his first working system before Congress), but nevertheless communicate.

Test Tones

Another of the hidden sounds you may hear are the various tones used for line testing. These may be transmitted at certain intervals, but this will vary from one location to another.

Tone Slope

This is a series of tones that sounds like a musical scale. It is used to check for line losses at different frequencies. It is quick, lasting less than a second, and sometimes repeats after a few minutes; possibly because the first series indicated some line loss.

The Milliwatt Test

This is a 1,004 Hz tone at 0 dB tone used to check for line losses, among other things, such as capacitance losses caused by wiretaps and forgotten multiple appearance points. It is very loud, so if you have the volume cranked up, it will definitely get your attention!

Sweep Tones

This is an audio tone that starts at just under 300 Hz and increases in frequency to a little over 3,000 Hz. Also, the higher end of this tone range detects losses from some inductive devices on the line such as a tap. The reason for this particular frequency range is that telephone

systems have a bandwidth of 300 to 3,000 Hz. It was also used, so I hear, to trigger or detect an Infinity Transmitter – a type of surveillance device that worked on telephone systems back in the 50s.

Most of these tones are used late at night, and sometimes can cause your phone to "try" to ring. A feeble sound, not quite a normal sounding ring, but one that may wake you up. You have probably experienced this before. Now, you know what it was!

Other tones you might hear include: 440/1,004/2,800 Hz (gain/slope tests); and 2713 Hz to activate Remote Isolation Devices (RIDS), a Maintenance Termination Unit (MTU), or Network Interface Unit (NIU).

Incoming Calls

When someone calls the line you are monitoring, you will hear a loud low frequency 'buzz' coming from the speaker of the device I will

Telephone Systems Information

http://mirror.lcs.mit.edu/telecom-archives/
Telecom Digest and Archives has a nice selection of links to sites about telephones. Something for everyone.

http://www.educatorscorner.com/experiments/1wav/signals1.html
Here at Educators Corner, you can listen to recorded sounds of various frequencies to use as a reference for the test tones described in this article. And, if you like, you can also listen to helicopters, departing 747s, whales, and jackhammers.

http://www.cisco.com/warp/public/788/net_signal_control.html
From Cisco, an excellent tutorial on the basics of telephone systems.

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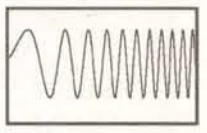
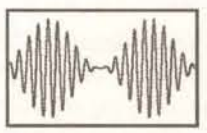
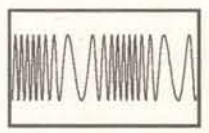
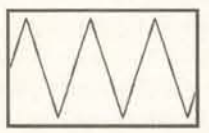
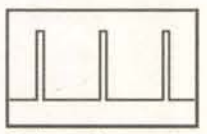
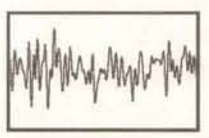

DC to 21.5 MHz linear and log sweeps

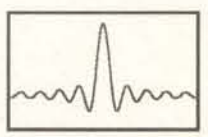

Int/Ext AM, SSB, Dualtone Gen.

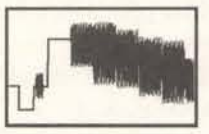

Int/Ext FM, PM, BPSK, Burst


Ramps, Triangles, Exponentials


Pulse Generator


Noise


Arbitrary Waveforms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describe later in this article. This ringing signal is usually between 20 and 72 Hz (with 20 Hz standard in the US) at a potential of between 40 and 150 volts (with 90 the US standard), depending on the length of the Local Loop. The ring signal duration is one-half to one-and-a-half seconds.

Turn the volume down before you answer or you will get feedback from the speaker. (And maybe a little from the person who called you when they hear the screeching sound!)

Environmental and Other Monitoring Systems

There are businesses that have facilities that require climate control, meaning a controlled temperature and humidity, but which are frequently unattended. So, they have monitoring systems set up which they can call to get a computer-generated report. Some of them will also open a microphone so that the caller can hear any unusual sounds in the area.

If there should be "trouble" on one of these lines, a telco technician might be notified via their beeper to call in for a 'trouble ticket' and, if the tech happens to use your line, you will hear both them calling in for messages and the synthesized voice of the automated system.

RTUs: Remote Test Units

There are different types of remote testing devices, including the Harris-Dracon DATU – Direct Access Test Unit. As I understand it, this is a gizmo that is attached to the distribution frame and can make a direct connection to any pair of wires.

The telco technician calls the access number which is answered, usually on the second ring. It is answered with what is much like an ordinary dial tone, followed by Touch Tones that the technician uses to activate various test functions. One of these is listening on the line – the tech can hear conversations on any line they use the DATU on, which is apparently frequency-inversion scrambled. But we know just how "secure" that is, don't we?

About the Tones

The numbers (Hz) may not mean anything, and unless you have perfect pitch or happen to have a scope (Photograph 1) on the line as I did in my experiment, you may wonder how you can tell one tone from another.

Some of them can be identified by logging elsewhere on to the web sites listed in the side bar, but as an example, the telephone dial tone is 350 and 440 Hz (together) which is lower in frequency than most test tones.

Others can be heard by dialing telco test lines, which usually have two zeros in the assigned prefix such as 440-00xx or 923.xx00. Since these numbers are considered to be proprietary (as far as I know), they can't be published here and, at any rate, they tend to change periodically.

The Device

Okay, already, what the heck is it? Hearing what is happening on your line is done with a simple device called a Listen-Down or Listen-Down-The-Line amplifier. This is nothing more complicated than a small amplified speaker connected to the line through a pair of .01 uF capacitors.

There are two ways to assemble this nifty device. You can get a small transistorized amplifier from any number of places – such as Electronic Rainbow or Alltronics – and connect it to a small speaker from your junk box. But the easiest, fastest, and least expensive method is to use a multimedia computer speaker. No, this doesn't mean tearing into the $$ Altec system with the SuperSubWoofer on the family computer which could get you into deep trouble. Most computer stores have low-cost speaker sets. The ones in Photograph 2 cost only $10.00.

The Connections

If you are anything like I am, when you start a new project, even a small one, you want to have everything you need to complete it. All you need is:

- Standard RJ-11 modular telephone cable.
- A modular splitter.
- One cable with a plug that fits the amplified speaker audio input.
- Two .01 uF disk ceramic capacitors.
- And a few inches of fine (AWG 22 or so) solid wire.

Clip the phone cable and strip off about two inches of insulation. Carefully trim off the synthetic fibers and wrap the hookup wire tightly around it. Then splice in the leads from the capacitors and solder them. The other ends of the caps go to the speaker cable. The capacitors block the 48-volt DC line voltage while allowing the audio through.

Now, apply power to the speaker, plug the modulator connector into a phone jack using the splitter, turn the volume up, and lift the phone's receiver. You will hear the dial tone coming from the speaker.

Adding a DTMF Decoder

Should you hear a sleeper and wonder what number they are calling, you can easily add a touch-tone decoder as shown in Photograph 1. They work from an audio signal – they are not connected directly to the phone line which could damage them – so all you need to do is take the audio output that goes from the amplified speaker to the other (left) speaker and plug that into the decoder.

Take your phone off-hook and dial a few numbers while adjusting the volume until you see the digits clearly displayed.

You're done. Now, sit back and listen to the hidden sounds on your telephone line.

If you hear something not covered in this article, I would like to hear from you. **NV**

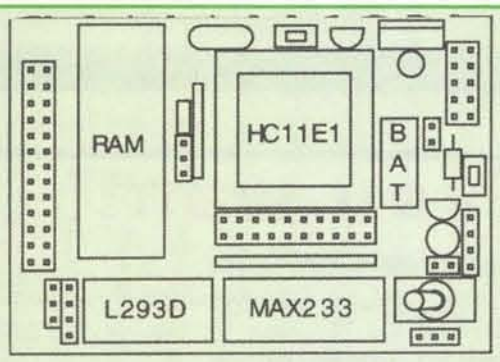
About the author

ML Shannon is a San Francisco writer, author of three books on electronic surveillance, and graduate of a two-year technical school in electronics. He has worked "both sides of the fence" as an employee of two corporations who designed and built surveillance equipment, as well as a technician for a professional TSCM countermeasures company.

Shannon has been a guest speaker on surveillance technology before scanner clubs and law enforcement agencies, and has been interviewed on radio talk shows and television.

He is presently at work on a new book, *Cyber-Street Survival* which is a beginner's guide to privacy and security on the Internet.

He can be reached at P.O. Box 192171, San Francisco, CA 94119-2171 or E-Mail **mshannon@fusionsites.com.**



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